

ence the number with the adjacent model number and year.

BASIC HAND TOOLS

Many of the procedures in this manual can be carried out with simple hand tools and test equipment familiar to the average home mechanic. Keep your tools clean and in a tool box. Keep them organized with the sockets and related drives together, the open-end combination wrenches together, etc. After

using a tool, wipe off dirt and grease with a clean cloth and return the tool to its correct place.

Top-quality tools are essential; they are also more economical in the long run. If you are now starting to build your tool collection, stay away from the "advertised specials" featured at some parts houses, discount stores and chain drug stores. These are usually a poor grade tool that can be sold cheaply and that is exactly what they are—*cheap*. They are usually made of inferior material, and are thick, heavy and clumsy. Their rough finish makes them difficult to clean and they usually don't last very long. If it is ever your misfortune to use such tools, you will probably find out that the wrenches do not fit the heads of bolts and nuts correctly and damage the fastener.

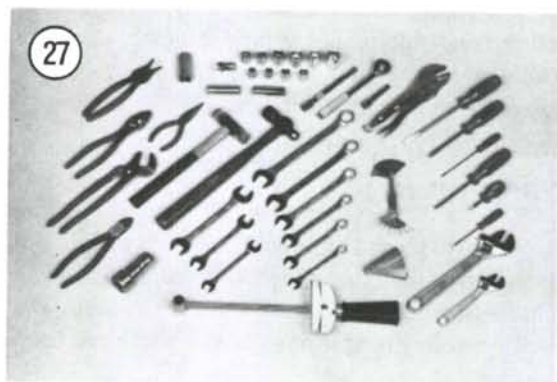
Quality tools are made of alloy steel and are heat treated for greater strength. They are lighter and better balanced than cheap ones. Their surface is smooth, making them a pleasure to work with and easy to clean. The initial cost of good-quality tools may be more but they are cheaper in the long run. Don't try to buy everything in all sizes in the beginning; do it a little at a time until you have the necessary tools.

The following tools are required to perform virtually any repair job on a vehicle. Each tool is described and the recommended size given for starting a tool collection. **Table 4** includes the tools that should be on hand for simple home repairs and/or major overhaul as shown in **Figure 27**. Additional tools and some duplicates may be added as you become more familiar with the vehicle. Almost all motorcycles and vehicles (with the exception of the U.S. built Harley and some English vehicles) use metric size bolts and nuts. If you are starting your collection now, buy metric sizes.

Screwdrivers

The screwdriver is a very basic tool, but if used improperly it will do more damage than good. The slot on a screw has a definite dimension and shape. A screwdriver must be selected to conform with that shape. Use a small screwdriver for small screws and a large one for large screws or the screw head will be damaged.

Two basic types of screwdrivers are required: common (flat-blade) screwdrivers (**Figure 28**) and Phillips screwdrivers (**Figure 29**).



Screwdrivers are available in sets which often include an assortment of common and Phillips blades. If you buy them individually, buy at least the following:

- a. Common screwdriver— $5/16 \times 6$ in. blade.
- b. Common screwdriver— $3/8 \times 12$ in. blade.
- c. Phillips screwdriver—size 2 tip, 6 in. blade.

Use screwdrivers only for driving screws. Never use a screwdriver for prying or chiseling metal. Do not try to remove a Phillips or Allen head screw with a common screwdriver (unless the screw has a combination head that will accept either type); you can damage the head so that the proper tool will be unable to remove it.

Keep screwdrivers in the proper condition and they will last longer and perform better. Always keep the tip of a common screwdriver in good condition. **Figure 30** shows how to grind the tip to the proper shape if it becomes damaged. Note the symmetrical sides of the tip.

Pliers

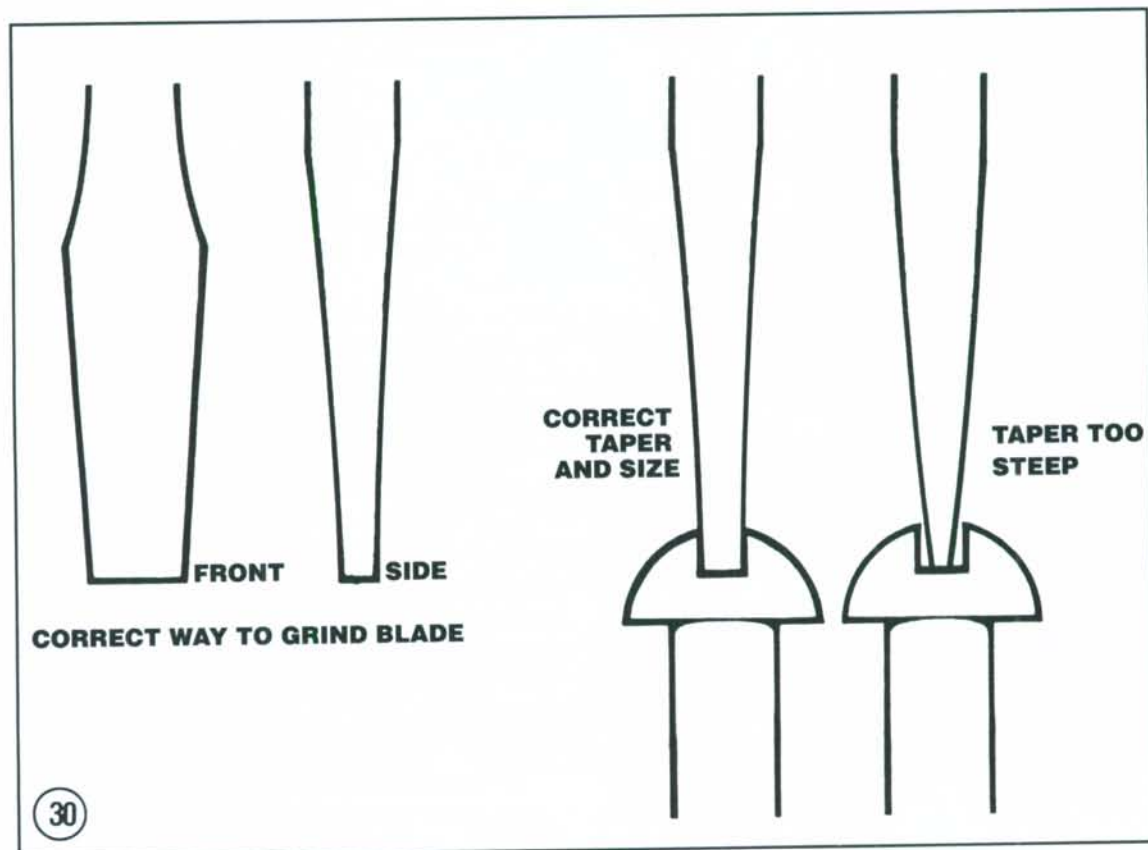
Pliers come in a wide range of types and sizes. Pliers are useful for cutting, bending and crimping. They should never be used to cut hardened objects or to turn bolts or nuts. **Figure 31** shows several pliers useful in motorcycle repairs.

Each type of pliers has a specialized function. Slip-joint pliers are general purpose pliers and are used mainly for holding things and for bending.

Needlenose pliers are used to hold or bend small objects. Channel lock pliers can be adjusted to hold various sizes of objects; the jaws remain parallel to grip around objects such as pipe or tubing. There are many more types of pliers. The ones described here are most suitable for vehicle repairs.

Vise-grip Pliers

Vise-grip pliers (**Figure 32**) are used to hold objects very tightly like a vise. But avoid using them unless absolutely necessary since their sharp jaws will permanently scar any objects which are held.





Vise-grip pliers are available in many types for more specific tasks.



Circlip Pliers

Circlip pliers (**Figure 33**) are special in that they are only used to remove circlips from shafts or within engine or suspension housings. When purchasing circlip pliers, there are two kinds to distinguish from. External pliers (spreading) are used to remove circlips that fit on the outside of a shaft. Internal pliers (squeezing) are used to remove circlips which fit inside a gear or housing.



WARNING

Because circlips can sometimes slip and "fly off" during removal and installation, always wear safety glasses.



Box-end, Open-end and Combination Wrenches

Box-end, open-end and combination wrenches are available in sets or separately in a variety of sizes. On open and box end wrenches, the number stamped near the end refers to the distance between 2 parallel flats on the hex head bolt or nut. On combination wrenches, the number is stamped near the center.

Open-end wrenches are speedy and work best in areas with limited overhead access. Their wide flat jaws make them unstable for situations where the bolt or nut is sunken in a well or close to the edge of a casting. These wrenches grip only two flats of a fastener so if either the fastener head or the wrench jaws are worn, the wrench may slip off.

Box-end wrenches require clear overhead access to the fastener but can work well in situations where the fastener head is close to another part. They grip on all six edges of a fastener for a very secure grip. They are available in either 6-point or 12-point. The 6-point gives superior holding power and durability but requires a greater swinging radius. The 12-point works better in situations with limited swinging radius.



Combination wrenches (**Figure 34**) have open-end on one side and box-end on the other with both ends being the same size. These wrenches are favored by professionals because of their versatility.

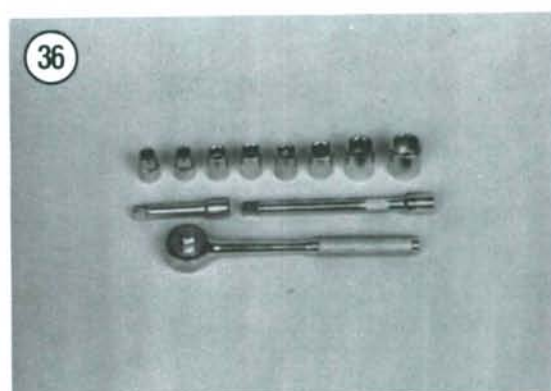
Adjustable (Crescent) Wrenches

An adjustable wrench (sometimes called crescent wrench) can be adjusted to fit nearly any nut or bolt head which has clear access around its entire perimeter. Adjustable wrenches (**Figure 35**) are best used as a backup wrench to keep a large nut or bolt from turning while the other end is being loosened or tightened with a proper wrench.

Adjustable wrenches have only two gripping surfaces which make them more subject to slipping off the fastener and damaging the part and possibly injuring your hand. The fact that one jaw is adjustable only aggravates this shortcoming.

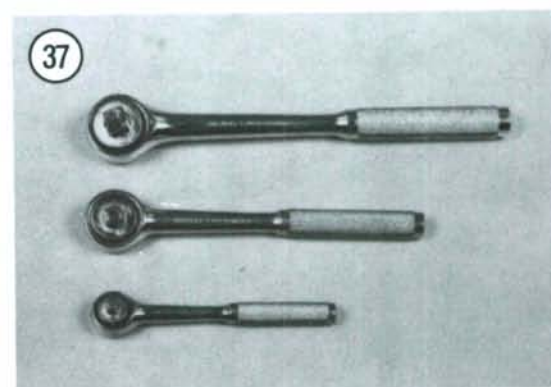
These wrenches are directional; the solid jaw must be the one transmitting the force. If you use the adjustable jaw to transmit the force, it will loosen and possibly slip off.

Adjustable wrenches come in all sizes but something in the 6 to 8 in. range is recommended as an all-purpose wrench.



Socket Wrenches

This type is undoubtedly the fastest, safest and most convenient to use. Sockets which attach to a ratchet handle (**Figure 36**) are available with 6-point or 12-point openings and 1/4, 3/8, 1/2 and 3/4 in. drives. The drive size indicates the size of the square hole which mates with the ratchet handle (**Figure 37**).



Allen Wrenches

Allen wrenches are available in sets or separately in a variety of sizes. These sets come in SAE and metric size, so be sure to buy a metric set. Allen bolts are sometimes called socket bolts. Some times the bolts are difficult to reach and it is suggested that a variety of Allen wrenches be purchased (e.g. socket driven, T-handle and extension type) as shown in **Figure 38**.



Torque Wrench

A torque wrench is used with a socket to measure how tightly a nut or bolt is installed. They come in a wide price range and with either 3/8 or 1/2 in. square drives (**Figure 39**). The drive size indicates the size of the square drive which mates with the

socket. Purchase one that measures 0-280 N·m (0-200 ft.-lb.).

Impact Driver

This tool might have been designed with the vehicle in mind. This tool makes removal of fasteners easy and eliminates damage to bolts and screw slots. Impact drivers and interchangeable bits (Figure 40) are available at most large hardware) motorcycle or auto parts stores. Don't purchase a cheap one as they do not work as well and require more force (the "use

a larger hammer" syndrome) than a moderately priced one. Sockets can also be used with a hand impact driver. However, make sure that the socket is designed for use with an impact driver or air tool. Do not use regular hand sockets, as they may shatter during use.

Hammers

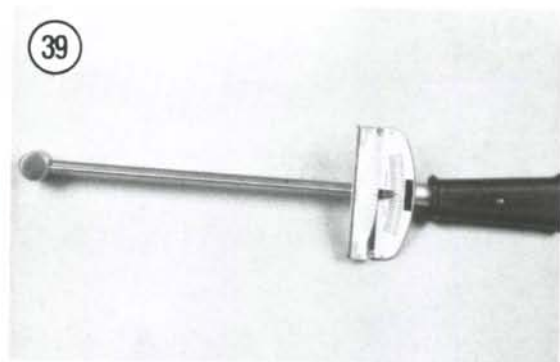
The correct hammer (Figure 41) is necessary for repairs. Use only a hammer with a face (or head) of rubber or plastic or the soft-faced type that is filled with buckshot. These are sometimes necessary in engine teardowns. *Never* use a metal-faced hammer on engine or suspension parts, as severe damage will result in most cases. You can always produce the same amount of force with a soft-faced hammer. A metal-faced hammer, however, will be required when using a hand impact driver.

PRECISION MEASURING TOOLS

Measurement is an important part of motorcycle service. When performing many of the service procedures in this manual, you will be required to make a number of measurements. These include basic checks such as valve clearance, engine compression and spark plug gap. As you get deeper into engine disassembly and service, measurements will be required to determine the size and condition of the piston and cylinder bore, valve and guide wear, camshaft wear, crankshaft runout and so on. When making these measurements, the degree of accuracy will dictate which tool is required. Precision measuring tools are expensive. If this is your first experience at engine or suspension service, it may be more worthwhile to have the checks made at a Honda dealer or machine shop. However, as your skills and enthusiasm increase for doing your own service work, you may want to begin purchasing some of these specialized tools. The following is a description of the measuring tools required during engine and suspension overhaul.

Feeler Gauge

Feeler gauges come in assorted sets and types (Figure 42). The feeler gauge is made of either a piece of a flat or round hardened steel of a specified



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